

Interoperability Readiness Levels

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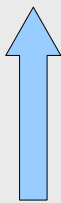
- Nine Levels of Interoperability
 - Inspired by Technology Readiness Levels and Reuse Readiness Levels
 - Each interoperability level (IRL) represents an increased ability for a system to interoperate with other systems
 - Based on four key interoperability dimensions
- Capability Enablement
 - Describes the overall capability enabled at a particular Interoperability Readiness Level
- Key Interoperability Dimensions
 - Discovery
 - Access
 - Understanding
 - Data
- 'Bonus' Interoperability Dimension
 - Standards (Individual, Organizational, Associational, National, International)
- Key Characteristics
 - Degree of human intervention required
 - Amount of custom coding vs. configuration
- Available on Google Docs
 - <http://tinyurl.com/tiwg-irl>



| | Capability Enablement | Discovery | Access | Understanding | Data | Standards |
|----------------|---|--|---|---|---|---------------------------------|
| Level 9 | Automatic discovery and incorporation of novel data and services into applications with no human intervention | Services discoverable in global registries with complete syntactic and semantic information | AI capability. Completely automated mediation of services | Semantic agreement on content based upon universally accepted ontologies | Data, its quality, realms of applicability, etc. fully self-described both syntactically and semantically | International standards. |
| Level 8 | Human-triggered incorporation of novel data and services into applications | Services discoverable in global registries of services with complete syntactic information | Discipline/Domain-specific ontology support using recognized semantic tools | Semantic agreement on content based upon community-accepted ontologies | Standard data types in syntactically self-describing formats, quality, applicability, etc. information partly semantically captured | |
| Level 7 | Incorporation of novel data and services into applications with minimal configuration | Services discoverable in community registries of services | Full registry support, discoverable, machine interpretable definitions, standardized/recognized data structures | Semantic agreement on content based upon ad hoc ontologies | Standard data types in syntactically self-describing formats, quality, applicability, etc. information not semantically captured | National standards. |
| Level 6 | Incorporation of novel data and services into applications with substantial configuration | Common catalog protocols with community vocabulary at both directory and inventory level, limited registry support, discoverable | Follows specification standards, supports recognized interface definition conventions (common vocab) human or machine interpreted | Semantic agreement on content based upon common vocabularies | Data in syntactically self-describing formats, some content info using community vocabularies | |
| Level 5 | Incorporation of novel data and services into applications with minimal custom code | Common catalog protocols with some conventions at directory and inventory level | Adherence to (documented) specification standards, distributed access providing platform independence (e.g. data type interoperability) | Semantic agreement on content based upon ad hoc community shared knowledge | Data in syntactically self-describing formats, content (i.e., semantics) info available as free text | Associational standards. |
| Level 4 | Programmatic access to data services from different sources via extensive custom code | Some common catalog conventions at directory (dataset) level | Documentation exists in common modern language(s) (no Latin), platform/language dependencies, distributed (non-standard) access | Semantic agreement on some of the content based upon ad hoc community shared knowledge | Data in documented formats with available IO routines and full content information available as free text | |
| Level 3 | Programmatic use of data from different sources via extensive custom code | Catalog accessible but undocumented and changing. Manual search. | One-off specialized implementations (no standardization of API or functionality), poor documentation | Extensive human-human interaction required to gain full meaning of data | Data in documented formats with full content information available as free text | Organizational-level standards. |
| Level 2 | Human use of data from different sources using different code for each | REST-style access to form interface (via scraping) | Proprietary and complicated dependencies, strict platform dependencies, limited documentation, no discovery (registry) | Some parts of data may be comparable to other data only through informal human to human interaction | Data in documented formats with little or no auxiliary content information available | |
| Level 1 | Data from different sources cannot be used together | Probably none, hard coded or inaccessible catalog interface | Not modular components (part of a larger application), platform specific, undocumented, no distributed access, closed/restricted source (not open source) | Content of data is not directly comparable to any other data | Data in unknown or undocumented formats with little or no auxiliary content information available | Individual standards. |

High IRLs

Extensive interoperability.
Little human interpretation
and intervention required.
Simple configuration rather
than custom coding.



Low IRLs

Little or no interoperability.
Significant human
interpretation and intervention
required.
Extensive custom coding.



Technology Readiness Levels

- NASA Civil Space Technology Readiness Levels: taken from NASA's 1991 Integrated Technology Plan; outlines the relative maturity of a given technology as follows:
- Basic Technology Research:
 - Level 1: Basic principles observed and reported
- Research to Prove Feasibility:
 - Level 2: Technology concept and/or application formulated
 - Level 3: Analytical and experimental critical function and/or characteristic proof of concept
- Technology Development:
 - Level 4: Component and/or breadboard validation in laboratory environment
- Technology Demonstration:
 - Level 5: Component and/or breadboard validation in relevant environment
 - Level 6: System/subsystem model or prototype demonstration in a relevant environment (ground or space)
- System/Subsystem Development:
 - Level 7: System prototype demonstration in a space environment
- System Test, Launch and Operations:
 - Level 8: Actual system completed and "flight qualified" through test and demonstration (ground or space)
 - Level 9: Actual system "flight proven" through successful mission operations

